ATLANTIS

VISITS
INTERNATIONAL SPACE STATION

STS-101

WWW.SHUTTLEPRESSKIT.COM

Updated April 7, 2000

STS-101 Table of Contents

Shuttle Reference and Data

Mission Overview

The development of the International Space Station (ISS) will continue during NASA's second shuttle flight of the year when Atlantis is launched on the STS-101 mission, the 98th flight in Shuttle program history.

Outfitted with a new "glass cockpit" and other state-of-the-art upgrades to key systems, Atlantis is scheduled to be launched from Complex 39-A at the Kennedy Space Center approximately 4:15 P.M. EDT April 24 at the start of a window of no longer than 10 minutes in duration. The precise launch time and duration of the launch opportunity will be narrowed within a week before the start of the mission to provide the best time for Atlantis to begin its two-day chase to catch up to the ISS. Atlantis last flew in space in support of the STS-86 mission in 1997. On STS-101, Atlantis will fly as the most updated Space Shuttle ever, with more than 100 new modifications incorporated during a 10-month period at Boeing's Palmdale, California Shuttle factory in 1998.

Seven astronauts, led by veteran Commander Jim Halsell (Col., USAF), will link up to the international outpost two days after launch and will spend six days docked to the ISS, four of which will be spent refurbishing and replacing components in both the Zarya and Unity modules. Two crew members will perform a six and a half hour space walk the day after docking to install a Russian "Strela" cargo boom on the outside of Zarya, as well as replace a faulty radio antenna associated with the early communications system on Unity and perform several other tasks in advance of space walks on future station assembly missions.

Halsell, who is making his fifth flight into space and third as a Commander, will be joined by veteran Pilot Scott Horowitz (Lt. Col., USAF), who is making his third flight.

Mission Specialists include Dr. Mary Ellen Weber, making her second flight, Jeff Williams (Lt. Col., USA), making his first trip into space, Jim Voss (Col., USA, ret.), embarking on his fourth flight, Susan Helms (Col., USAF), making her fourth flight, and veteran Russian cosmonaut Yuri Usachev, who is making his third flight into space and who has logged 376 days in space and six space walks during two previous missions aboard the Mir Space Station. Usachev and fellow cosmonaut Yuri Onufrienko hosted astronaut Shannon Lucid during Usachev's second flight on the Mir. Lucid went on to set a U.S. single spaceflight endurance mark of 188 days on that mission.

Usachev, Voss and Helms will return to the ISS next year as the second crew to live and work aboard the station. Permanent occupancy of the ISS is scheduled to begin in the fall by the Expedition One crew, William Shepherd, Yuri Gidzenko and Sergei Krikalev, who will be launched on a Russian Soyuz rocket from the Baikonur Cosmodrome in Kazakhstan.

Williams and Voss are the two space walkers during Atlantis' planned 10-day flight. Williams, who has no previous space walk experience, will carry the designation of EV 1 during the planned excursion outside Atlantis and will wear the suit marked with red stripes on the elbows and the knees. Voss will be designated EV 2 and will wear the pure white suit. He conducted one previous space walk during the STS-69 mission in 1995 lasting almost seven hours.

The STS-101 mission originally was designed to follow the launch of the Zvezda Service Module as the flight to outfit the Russian component as the early living quarters for crews aboard the ISS. When Zvezda's launch was delayed, Shuttle and Station managers agreed to fly Atlantis on two separate flights to the station this year, STS-101 to conduct maintenance and logistics work aboard the ISS in advance of Zvezda's arrival, and STS-106, to unload supplies onto Zvezda from both the Shuttle and a Russian Progress resupply vehicle. STS-106 is scheduled for launch in August, about five weeks after Zvezda's planned July launch on a Proton rocket from Baikonur.

The top priority of the docked phase of the mission is to replace four of six 800-ampere power-producing batteries in Zarya which are no longer operable, and its associated electronics for proper current regulation.

Zarya will receive additional new equipment including four cooling fans, three fire extinguishers, 10 smoke detectors and an on-board computer. A suspect radio frequency power distribution box (RFPDB) in Unity used as part of the early S-band communications system will be replaced during the time Atlantis is linked to the new international facility.

The crew plans to transfer almost one ton of equipment from a double Spacehab module housed at the rear of Atlantis' cargo bay into Zarya and Unity for use by the Expedition One crew later this year. Those logistical items include personal clothing and hygiene gear, medical and exercise equipment, computer equipment and printers, hardware for the eventual setup and activation of the station's Ku-band communications system and a centerline camera for Unity's common berthing mechanisms to which other ISS components will be mated. Four large bags of water will also be brought from Atlantis into the ISS for later use.

The cost for all of the hardware and logistical supplies being carried to the Station is approximately $1.5 million. Slightly more than $1.3 million of that total cost will be assumed by Russia for new or replacement Russian hardware, while the portion for new and or replacement U.S. hardware is $162,000.

The next mission to expand the capacity of the International Space Station, will be the launch of the Zvezda Service Module in mid-July.

Adjustments to the official near term assembly sequence were agreed to by the International Partners and participants at a recent Space Station Control Board meeting. Representatives included the United States, Russia, Canada, Japan, the European Space Agency, Italy and Brazil.

The following is the updated near term assembly sequence through August 2001 with the no-earlier-than target launch dates. The complete assembly sequence can be viewed on NASA's Human Spaceflight Website at: http://spaceflight.nasa.gov/station/assembly/flights/chron.html

International Space Station Assembly Sequence March 2000 Update

Date	Flight	Launch Vehicle	Element(s)
Nov 20, 1998	1A/R	Russian Proton	'Zarya' Control Module
Dec 3, 1998	2A	Space Shuttle (STS-88)	'Unity' Connecting Module
May 27, 1999	2A.1	Space Shuttle (STS-96)	Spacehab - Logistics Flight
April 13, 2000	2A.2A	Space Shuttle (STS-101)	Spacehab - Maintenance Flt.
July 8-14, 2000	1R	Russian Proton	'Zvezda' service module
Aug 19, 2000	2A.2B	Space Shuttle (STS-106)	Spacehab - Logistics Flight
Sept 21, 2000	3A	Space Shuttle (STS-92)	Integrated Truss Structure (ITS) Z1; Pressurized Mating Adapter-3; Control Moment Gyros (CMGs)
Oct 30, 2000	2R	Russian Soyuz	Expedition 1 Crew launch
Nov 30, 2000	4A	Space Shuttle (STS-97)	Integrated Truss Structure(P6) Photovoltaic Module;Radiators
Jan 18, 2001	5A	Space Shuttle (STS-98)	'Destiny' laboratory module
Feb 9, 2001	4R	Russian Soyuz	Docking Compartment
Feb 15, 2001	5A.1	Space Shuttle (STS-102)	'Leonardo' Multi-Purpose Logistics Module (MPLM)
Apr 19, 2001	6A	Space Shuttle (STS-100)	'Rafaello' MPLM Station Remote Manipulator System
Apr 30, 2001	2S	Russian Soyuz	Soyuz spacecraft swap
May 17, 2001	7A	Space Shuttle (STS-104)	Airlock
June 21, 2001	7A.1	Space Shuttle (STS-105)	'Donatello' MPLM
Aug 23, 2001	UF-1	Space Shuttle (STS-109)	First utilization flight

If all goes as planned, Atlantis will conclude its mission at approximately 12:50 P.M. EDT on May 4 with a touchdown at the Shuttle Landing Facility at the Kennedy Space Center.

Updated: 04/06/2000

STS-101

Atlantis OV104

Launch: Monday, April 24, 2000
4:15 PM (eastern time)

Mission Objectives

A categorical priority system is used to guide the ordering of key operations tasks and places the highest value on ensuring crew safety. The priorities for STS-101/2A.2a are:

1. ISS ingress/safety
- Take air samples
- Monitor carbon dioxide
- Deploy portable, personal fans
- Measure air flow
- Rework/modify ISS ducting
- Replace air filters
- Replace Zarya fire extinguishers, smoke detectors

2. Critical replacements/repairs/spares
- Replace four suspect batteries on Zarya
- Replaced failed or suspect electronics for Zarya's batteries
- Replace Radio Telemetry System memory unit
- Replace port early communications antenna
- Replace Radio Frequency Power Distribution Box
- Clear Space Vision System target

3. Incremental assembly/upgrades
- Complete assembly of Strela crane
- Install additional exterior handrails
- Set up center-line camera cable
- Install "Komparus" cable inserts
- Reseat the U.S. crane

4. Assembly parts & equipment
- Transfer U.S. hardware
- Transfer Russian hardware
- Provide EVA tools
- Supply IVA kit

5. Pre-position/stow equipment & provisions for future missions

6. Resupply
- Water and water transfer, stowage equipment
- Docking mechanism accessory kit
- Film and video tape for documentation
- Office supplies
- Personal items

7. Crew health maintenance
- Exercise equipment
- Medical support supplies
- Formaldehyde monitor kit
- Passive dosimetry system

8. Detailed test objectives
- Monitor cabin air
- SOAR

Options

If there is sufficient shuttle propellant following Atlantis' undocking from the ISS, a flyaround inspection will be performed prior to the Shuttle's final separation maneuver.

Crew

Commander:	James D. Halsell
Pilot:	Scott J. Horowitz
Mission Specialist 1:	Mary Ellen Weber
Mission Specialist 2:	Jeffrey N. Williams
Mission Specialist 3:	James S. Voss
Mission Specialist 4:	Susan J. Helms
Mission Specialist 5:	Yuri V. Usachev

Launch

Orbiter:	Atlantis OV104
Launch Site:	Kennedy Space Center Launch Pad 39A
Launch Window:	5 minutes
Altitude:	173 Nautical Miles
Inclination:	51.6 Degrees
Duration:	9 Days 20 Hrs. 36 Min.

Vehicle Data

Shuttle Liftoff Weight: 4519492 lbs.
Orbiter/Payload Liftoff Weight: 262565 lbs.
Orbiter/Payload Landing Weight: 224504 lbs.

Payload Weights

ICC	3,700 pounds
MARS	270 lb

Software Version: OI-27

Space Shuttle Main Engines

SSME 1: 2043 **SSME 2:** 2054 **SSME 3:** 2049

External Tank: ET-102

SRB Set: BI-100/RSRM-74

Shuttle Aborts

Abort Landing Sites

RTLS: Kennedy Space Center Shuttle Landing Facility
TAL: Zaragoza
AOA: Edwards Air Force Base, California

Landing

Landing Date: 05/04/00
Landing Time: 12:50 PM (eastern time)
Primary Landing Site: Kennedy Space Center Shuttle Landing Facility

---

Payloads

Cargo Bay

BioTube Precursor Experiment
SPACEHAB
Integrated Cargo Carrier
Mission to America's Remarkable Schools
Space Experiment Module 6

In-Cabin

HTD 1403 Micro Wireless Instrumentation System (Micro WIS) HEDS Technology Demonstration

Crew Profile Menu

Commander: James D. Halsell

Jim Halsell (Col., USAF) is Commander for STS-101. Halsell will be responsible for overall mission success and safety during STS-101, as well as the rendezvous and docking of Atlantis to the International Space Station.
Halsell, 43, is making his fifth flight into space, having previously flown as Pilot on STS-65 in 1994 and STS-74 in 1995 and as Commander of STS-83 and 94 in 1997.

Ascent Seating: Flight Deck - Port Forward
Entry Seating: Flight Deck - Port Forward

Pilot: Scott J. Horowitz

Scott Horowitz (Lt. Col., USAF) is Pilot for STS-101.

Horowitz will be the intravehicular crew member during the space walk by Jeff Williams and Jim Voss during the flight, responsible for the choreography of the 6 ½ hour excursion outside Atlantis.

Horowitz will also help in the replacement of some of the equipment in the Unity module on the ISS and the inspection and installation of other systems in the Zarya module.
Horowitz, 43, is making his third flight into space after serving as Pilot on STS-75 in 1996 and STS-82 in 1997.

Ascent Seating: Flight Deck - Starboard Forward
Entry Seating: Flight Deck - Starboard Forward
IV1

Mission Specialist 1: Mary Ellen Weber

Dr. Mary Ellen Weber, 37, is Mission Specialist 1 during the STS-101 mission.

Weber will be responsible for the transfer of logistics items from

Atlantis to the International Space Station during the flight and will operate the Shuttle's robot arm during the space walk by Jeff Williams and Jim Voss.

Weber will ride upstairs on Atlantis' flight deck for both launch and landing and will be responsible for Spacehab systems for the cargo carrier housed in Atlantis' payload bay. Weber previously flew on the STS-70 mission in 1995.

Ascent Seating: Flight Deck - Starboard Aft
Entry Seating: Flight Deck - Starboard Aft
RMS

Mission Specialist 2: Jeffrey N. Williams

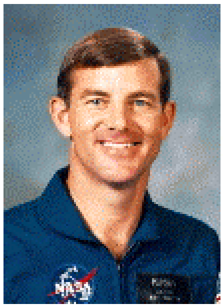
Jeff Williams (Lt. Col., USA) will serve as Atlantis' flight engineer during STS-101, which will be his first flight into space.

Williams, 42, who will be designated Mission Specialist 2, will be the lead space walker (EV 1) during the excursion he and Jim Voss will conduct to work on the International Space Station. He will wear the suit with the red stripes on the arms and knees of his space suit.

During the docked phase of the flight, Williams will transfer batteries and other electronics equipment into the Zarya module for installation as well as other logistics items.

Ascent Seating: Flight Deck - Center Aft
Entry Seating: Flight Deck - Center Aft
EV1

Mission Specialist 3: James S. Voss



Jim Voss (Col., USA, ret.) will make his fourth flight into space as Mission Specialist 3 during STS-101. He is also a member of the Expedition Two crew, which will be launched in 2001 for a three to four month stay aboard the International Space Station.

Voss, who conducted one space walk on STS-69, will join Jeff Williams as EV 2 for the 6 ½ hour space walk during STS-101 to work on the International Space Station. He will wear the pure white space suit.

Voss will also be responsible for air quality measures inside the ISS during docked operations and the replacement of equipment inside the Unity module. He will ride downstairs in Atlantis' middeck during launch and landing.
Voss, 51, previously flew on STS-44 in 1991, STS-53 in 1992 and STS-69 in 1995.

Ascent Seating: Mid Deck - Port
Entry Seating: Mid Deck - Port
EV2

Mission Specialist 4: Susan J. Helms

Susan Helms (Lt. Col., USAF), will make her fourth flight into space as Mission Specialist 4 during STS-101.

Helms, 42, is also a member of the Expedition Two crew, which will be launched in 2001 for a 3-4 month stay aboard the International Space Station. During STS-101, Helms will help conduct the replacement of a battery and associated electronic equipment in the Zarya module and will replace and inspect other equipment in both Zarya and the Unity module.

She will ride downstairs in Atlantis' middeck during launch and landing.

Ascent Seating: Mid Deck - Center
Entry Seating: Mid Deck - Center

Mission Specialist 5: Yuri V. Usachev

Yuri Usachev, 42, will serve as Mission Specialist 5 during STS-101. The veteran Russian cosmonaut has spent 376 days in space and has conducted six space walks during two long duration missions aboard the Mir Space Station.

Usachev will serve as the Commander of the Expedition Two crew along with Jim Voss and Susan Helms, which is scheduled for launch in 2001 for a 3-4 month stay on the International Space Station.

On STS-101, Usachev will be responsible for the replacement of a battery and associated electronic equipment in the Zarya module and will help replace and inspect other equipment in both Zarya and the Unity module. Usachev will join Helms and Voss downstairs in Atlantis' middeck for both launch and landing.

Ascent Seating: Mid Deck - Starboard
Entry Seating: Mid Deck - Starboard

Updated: 03/27/2000

Shuttle Reference and Data

Orbiter Upgrades

The 21st Century Space Shuttle: New Improvements

The space shuttle has undergone significant changes. From the inside out, thousands of advances in technology and enhanced designs have been incorporated into the shuttle since it was first launched. The result is a safer, more powerful and more efficient spacecraft. When the shuttle Atlantis launches on STS-101, it will be the most up-to-date space shuttle ever. From a new "glass cockpit" to main engines estimated to be three times safer, Atlantis is a far different vehicle from the one that first flew in 1985.

This year also will see the 100th space shuttle launch in history, a milestone for a spacecraft that has taken over 600 passengers and three million pounds of cargo to orbit. The shuttle fleet has spent almost two and a half years in space. But even the most-traveled shuttles remain young in the lifespan for which they were built. NASA is preparing for the possibility of flying the space shuttle for at least another decade, and future improvements are geared toward a goal of doubling shuttle safety by the year 2005.

The New "Glass Cockpit"

For the first time, on mission STS-101, 11 new full-color, flat-panel display screens in Atlantis's cockpit will replace 32 gauges and electromechanical displays and four cathode-ray tube displays. This new "glass cockpit," technically labeled the Multifunction Electronic Display Subsystem (MEDS), is 75 pounds lighter and uses less power than before; and its color displays facilitate pilot recognition of key functions. The new cockpit will be installed in all shuttles by 2002, setting the stage for the next cockpit improvement planned for 2005: a "smart cockpit" that reduces pilot workload during critical periods.

On STS-101, Atlantis will fly with more than 100 new modifications incorporated during a 10-month period at Boeing's Palmdale, Calif., facility in 1998. The airlock was relocated to the payload bay to prepare for International Space Station assembly flights; the communications system was updated; several weight reduction measures were installed; enhancements were made to add protection to the cooling system; and the crew cabin floor was strengthened. The shuttle Columbia is at the Palmdale factory this year receiving many of the same upgrades, including installation of the new "glass cockpit."

Future Shuttle Upgrades: Cutting Risk in Half by 2005

Enhancements now under development could double the shuttle's safety by 2005. New sensors and computer power in the main engines will "see" trouble coming a split second before it can do harm, allowing a safe engine shutdown. A new engine nozzle will eliminate the need for hundreds of welds and potential leaks. Electric generators for the shuttle's hydraulics will replace the highly volatile rocket fuel that now powers the system. And a next-generation "smart cockpit" will reduce the pilot's workload in an emergency, allowing the crew to better focus on critical tasks. Other improvements will make steering systems for the solid rocket boosters more reliable, make the manufacturing of solid propellant safer and increase the strength of external fuel tank welds.

"Smart Cockpit"--The new "glass cockpit" that will be initiated when Atlantis launches on STS-101 is the precursor of the "smart cockpit" planned for 2005. The enhanced displays of the "smart cockpit" will not fly the shuttle, but they will do much of the deductive reasoning required for a pilot to respond to a problem. By simplifying the pilot's job, this "smart cockpit" will allow astronauts to better focus on critical tasks in an emergency.

Better Main Engines--The space shuttle's main engines operate at greater extremes of temperature and pressure than any other machine. Since 1981, three overhauls of the original design have more than tripled estimates of their safety. Now, a fourth major overhaul will make them even safer by 2005. Planned improvements include a high-tech optical and vibration sensor system and computing power in the engines that detects trouble in advance. This advanced health monitoring system has sensors that will detect and track an almost microscopic flaw in an engine's performance in a split second, allowing the engine to be safely shut down before the situation can grow out of control. Also, the engine's main combustion chamber will be enlarged to reduce the pressures on internal components without reducing the thrust; and a new, simplified engine nozzle design will eliminate hundreds of welds--over 500 feet of them--and potential leaks.

Safer Hydraulic Power--Aside from the main engines and solid rocket boosters, the single highest risk shuttle subsystems are the auxiliary power units, generators that power the hydraulic systems. Today, these generators use a highly volatile and toxic rocket fuel. But recent advances in battery and electrical power technology--much of which was developed by the automotive industry--will replace that system by 2005, eliminating many hazards not only in flight but also on the ground. Electric motors, powered by a bank of lightweight batteries, will be developed to power the shuttle's hydraulic system, providing greater reliability for astronauts in flight and a safer workplace for ground crews.

Solid Rocket Boosters and External Tank Upgrades--Future improvements for the solid rocket boosters include a redesign of several valves, filters and seals in the steering system to enhance their reliability as well as studies of the potential for an electrical system to power the booster hydraulics. In addition, changes in the solid rocket propellant manufacturing process will make the workplace safer for shuttle technicians. For the external tank, a new friction-stir welding technique will produce stronger and more durable welds throughout the structure.

Major Space Shuttle Improvements: A Brief History

April 1983, STS-6: A Lighter Fuel Tank--A redesigned lightweight external tank, 10,000 pounds lighter than the original design, flew on STS-6 in 1983, increasing the shuttle's cargo capacity by the same amount. In 1998, a super-lightweight external tank flew on STS-91, further reducing the tank's weight by 7,500 pounds and again increasing the shuttle's cargo capacity by the same amount. The super- lightweight tank is made of a Lockheed Martin-developed aluminum-lithium alloy that is not only lighter but also 30 percent stronger than the previous tank design.

September 1988, STS-26: Return to Flight--When Discovery returned the shuttle fleet to space following the Challenger accident, more than 200 safety improvements and modifications had been made. They included a major redesign of the solid rockets boosters, the addition of a crew escape and bailout system, stronger landing gear, more powerful flight control computers, updated inertial navigation equipment and several updated avionics units.

May 1992, STS-49: Endeavour's Maiden Voyage--Endeavour's first flight in 1992 was the debut of many shuttle improvements, including a drag chute to assist braking during landing, improved nosewheel steering, lighter and more reliable hydraulic power units, and updates to a variety of avionics equipment.

June 1992, STS-50: Extended-Duration Flights--Columbia was the first shuttle to be modified for allow long-duration flights and flew the first such mission in 1992. The modifications included an improved toilet, a regenerative system to remove carbon dioxide from the air, connections for a pallet of additional hydrogen and oxygen tanks to be mounted in the cargo bay, and extra stowage room in the crew cabin.

June 1995, STS-71: International Space Station Assembly--The first shuttle/Mir docking mission featured new shuttle changes that allowed it to dock with the Russian space station and prepare for assembly of the International Space Station. For the shuttle to dock with Mir and ISS, the airlock had to be moved from inside the cabin to the cargo bay on all orbiters except Columbia. Weight was also reduced through lightweight lockers, seats and other cabin equipment. Those changes, coupled with the super-lightweight external tank and performance improvements, increased the shuttle's cargo capacity by 16,000 pounds since 1992.

July 1995, STS-70: Space Shuttle Main Engines--Three major redesigns have more than tripled estimates of shuttle main engine safety. The first redesign (called the Block I engine), first flown in 1995, included changes to strengthen the oxygen turbopump and engine powerhead. The second overhaul, called the Block IIA engine, included a larger throat in main combustion chamber and first flew on STS-89 in January 1998. The third redesign, called the Block II engine, includes a stronger fuel turbopump and will fly for the first time in 2000. A fourth major overhaul is now planned to fly by 2005. Called the Block III engine, it will include further improvement of the combustion chamber and a simplified nozzle design.

Today's Space Shuttle--Since 1992, not only has the cargo capacity of the shuttle increased by 8 tons, the annual cost of operating the shuttle has decreased by 40 percent. Improvements in the main engines and other systems have reduced the estimated risks during launch by over 80 percent. And the number of all actual problems experienced by the shuttle in flight has decreased by 70 percent. Although they have flown for almost 20 years, the space shuttle orbiters have used only about a quarter of the lifetime for which they was designed. Discovery, which has flown the most missions, has completed 27 trips to space out of the 100 flights that all the shuttles were originally designed to complete.

Updated: 04/06/2000

Flight Day Summary

DATE TIME (EST)	DAY	MET	EVENT
04/24/00 4:14:50 PM	0	000/00:00:00	Launch
04/26/00 9:08:30 AM	3	001/16:53:40	ISS Docking
04/27/00 7:49:50 AM	4	002/15:35:00	EVA 1 Begins
04/28/00 6:14:50 AM	5	003/14:00:00	ISS Ingress Begins
04/29/00 4:44:50 AM	4	004/12:30:00	Reboost Begins
05/01/00 9:29:50 AM	8	006/17:15:00	ISS Egress Begins
05/02/00 3:59:19 AM	9	007/11:44:29	ISS Undock
05/04/00 11:46:25 AM	11	009/19:31:35	Deorbit Tig
05/04/00 12:50:50 PM	11	009/20:36:00	KSC Landing

Updated: 04/05/2000